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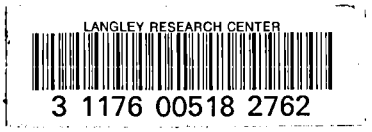

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User's Manual for the Coupled Rotor/Airframe Vibration Analysis Graphics Package

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USER'S MANUAL FOR THE COUPLED ROTOR/AIRFRAME VIBRATION ANALYSIS GRAPHICS PACKAGE

By R. E. Studwell

N82-31299#

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SUMMARY*

This manual contains user instructions for the Tektronix Graphics Package of the Coupled Rotor/Airframe Vibration Analysis. The manual describes responses to plot package messages which the user must make to activate plot package operations and options. The manual also contains installation instructions required to set up the program on the CDC system. The manual describes the plot package overlay structure and subroutines which have to be modified for the CDC system. Operating instructions for CDC applications are included.

* The research effort which led to the results in this report was financially supported by the Structures Laboratory, USARTL, (AVRADCOM).

INTRODUCTION

The Coupled Rotor/Airframe Vibration Analysis Program is a computer program which simulates the coupled dynamics of a helicopter airframe and rotor system. The program serves as a design tool for predicting helicopter vibrations. The analysis is used to predict vibrations for parametric studies conducted in the preliminary design phase. The analysis has the capability for representing various dynamic configurations, including the rotor system, fixed system and rotating system vibration absorbers, and vibration isolation devices.

Advances in computer capabilities and speed have made the solutions to problems of this magnitude practical. The one drawback is the amount of output data generated rapidly overwhelms the user and results in a formidable, time-consuming task for assimilating the results and making a design decision. To aid the user in the output evaluation process, a graphics package has been developed which interfaces with the main program output. This graphics package is an interactive stand-alone program which accesses the main program output files providing a rapid assimilation with graphic output of any desired component output.

This manual provides the basic operating instructions for the coupled rotor/airframe vibration analysis graphics package (SIMPLT).

BASIC OPERATING INSTRUCTIONS

The coupled rotor/fuselage vibration analysis graphic package is an interactive program. This program can only be run if an output file from the main engineering program exists. This program was developed for application with Tektronix 4000 series storage tube interfaces.

Being an interactive program, it is by necessity a conversational program. That is, the program will ask the user various questions as to what he wants to do. The resultant graphic output will depend on the responses the user provides.

At the outset, it should be pointed out that the response to all questions ending with a question mark (?) is Y for yes, N for no. All digital inputs are in I1 format unless otherwise specified. Note that a character must be transmitted with each return key. Failure to do so will result in abnormal termination.

To understand the questions and inputs required, various program operating paths are described below. Initial session program activation will write a message to the screen stating 'key in ., clear screen, hit return to continue'. Key in a decimal point, clear the screen, then transmit the return key. This procedure initializes the plot package commons and activates all plot file allocation requirements. All screen erasures become automatic after this.

The program will then solicit the 'BAUD' rate. This input refers to the rate of data transmission between the computer main frame and the terminal device. For a baud rate of 1200, the rate of transmission is 120 bits/second (BPS), 2400 is 240 BPS, etc. This solicitation is displayed only once during a given session and it must be keyed in correctly in I4 format. Transmission of the wrong baud rate could adversely affect the graphic output. If it is keyed in incorrectly, the only recovery is to start execution over. Users are advised to determine the baud rate prior to execution.

The program will then ask 'REVIEW CASE TITLES?' The response of Y-return will provide the user with the first line of title data along with the file case number and the number of co-ordinates used for each case. This becomes useful for identification of which case is to be plotted. When the listing is complete, the program will go into a hold state, permitting the user to review data until ready to proceed. Transmission of a decimal point will re-activate the program. It should be noted that this hold state will be activated after 30 case titles have been written to the screen. Transmission of a decimal point at this point will clear the screen and retrieve more case titles if any. A maximum of 99 cases can be stored on a given output file.

The statement 'HOW MANY CURVES ON THIS PLOT? - 5 MAX -' will then appear on the screen. The user can select from 1 to 5 curves to be plotted on a single frame. The input here is the user's choice using I1 format. The user must depress the return key after each input selection.

'ARE ALL THE CURVES FROM THE SAME CASE?' is displayed next. The program allows the user to select up to five curves to be plotted on a given frame. These curves can be selected as n variables from a given case or as 1 variable from n different cases, where n refers to the number of curves selected.

SINGLE CASE PLOTTING

Assume that the user wants to plot 3 curves from the same case. The user would transmit a Y (yes). The program would then display 'KEY IN THE CASE NUMBER DESIRED. I2 FORMAT'. If the data are from case 3, the input would be 03. If the requested case number is not on the file, the program will so state and return to the 'REVIEW CASE TITLES?' position. If the selected case isn't there, it would be advisable to check on what is there or check the case number input. If only a 3 was transmitted, the program will assume case 30 due to the I2 format requirement.

After the case number is transmitted, the program will request the variable number(s) to be plotted. These variable number(s) refer to the co-ordinate numbers as listed in the engineering output data. A typical output listing is shown in Figure 1.

The user must refer to this output listing for the selection of the desired variables. The desired variables are keyed in by coordinate number in nI3 format. The n refers to the number of variables which must be input, which is the number of curves selected. These coordinate selections must be input on one card, (input line). The input of the desired variables can be input in random order and will always be plotted in this input order.

After the curves have been selected, the program will request the type of plot desired with the question 'SURFACE PLOTS.' Two types of plots are available, standard and surface plots. The standard plot is the typical X-Y plot with all curves superimposed on one frame. A typical standard plot is shown in Figure 2A. A typical surface plot is shown in Figure 2B. The default to the question 'SURFACE PLOTS?' is standard plots.

FIGURE 1

NUMBER	OUTPUT COORDINATES				VALUE
1	ELEMENT	1	ISI	XT	AMPLITUD	0.0
2	ELEMENT	1	ISI	XT	PHASE	0.0
3	ELEMENT	1	ISI	YT	AMPLITUD	0.0
4	ELEMENT	1	ISI	YT	PHASE	0.0
5	ELEMENT	1	ISI	ZT	AMPLITUD	4.1730D-04
6	ELEMENT	1	ISI	ZT	PHASE	-9.0305D+01
7	ELEMENT	1	ISI	XB	AMPLITUD	0.0
8	ELEMENT	1	ISI	XB	PHASE	0.0
9	ELEMENT	1	ISI	YB	AMPLITUD	0.0
10	ELEMENT	1	ISI	YB	PHASE	0.0
11	ELEMENT	1	ISI	ZB	AMPLITUD	6.2193D-04
12	ELEMENT	1	ISI	ZB	PHASE	-9.0091D+01
13	ELEMENT	1	ISI	XBT	AMPLITUD	0.0
14	ELEMENT	1	ISI	YBT	PHASE	0.0
15	ELEMENT	1	ISI	YBT	AMPLITUD	0.0
16	ELEMENT	1	ISI	YBT	PHASE	0.0
17	ELEMENT	1	ISI	ZBT	AMPLITUD	4.1730D-04
18	ELEMENT	1	ISI	ZBT	PHASE	-9.0305D+01
19	ELEMENT	1	ISI	TXBT	AMPLITUD	0.0
20	ELEMENT	1	ISI	TXBT	PHASE	0.0
21	ELEMENT	1	ISI	TYBT	AMPLITUD	0.0
22	ELEMENT	1	ISI	TYBT	PHASE	0.0
23	ELEMENT	1	ISI	TZBT	AMPLITUD	0.0
24	ELEMENT	1	ISI	TZBT	PHASE	0.0
25	ELEMENT	1	ISI	XBF	AMPLITUD	0.0
26	ELEMENT	1	ISI	XBF	PHASE	0.0
27	ELEMENT	1	ISI	YBF	AMPLITUD	0.0
28	ELEMENT	1	ISI	YBF	PHASE	0.0
29	ELEMENT	1	ISI	ZBF	AMPLITUD	9.9550D-04
30	ELEMENT	1	ISI	ZBF	PHASE	-8.9930D+01
31	ELEMENT	1	ISI	TXBF	AMPLITUD	0.0
32	ELEMENT	1	ISI	TXBF	PHASE	0.0
33	ELEMENT	1	ISI	TYBF	AMPLITUD	0.0
34	ELEMENT	1	ISI	TYBF	PHASE	0.0
35	ELEMENT	1	ISI	TZBF	AMPLITUD	0.0
36	ELEMENT	1	ISI	TZBF	PHASE	0.0
37	ELEMENT	2	MSL	MODE	AMPLITUD	9.9550D-04
38	ELEMENT	2	MSL	MODE	PHASE	-8.9930D+01
39	ELEMENT	3	MSL	MODE	AMPLITUD	4.1730D-04
40	ELEMENT	3	MSL	MODE	PHASE	-9.0305D+01
41	ELEMENT	4	GFI	X	AMPLITUD	0.0
42	ELEMENT	4	GFI	X	PHASE	0.0
43	ELEMENT	4	GFI	Y	AMPLITUD	0.0
44	ELEMENT	4	GFI	Y	PHASE	0.0
45	ELEMENT	4	GFI	Z	AMPLITUD	4.1730D-04
46	ELEMENT	4	GFI	Z	PHASE	-9.0305D+01
47	ELEMENT	4	GFI	THTX	AMPLITUD	0.0
48	ELEMENT	4	GFI	THTX	PHASE	0.0
49	ELEMENT	4	GFI	THTY	AMPLITUD	0.0
50	ELEMENT	4	GFI	THTY	PHASE	0.0
51	ELEMENT	4	GFI	THTZ	AMPLITUD	0.0
52	ELEMENT	4	GFI	THTZ	PHASE	0.0

FIGURE 2A

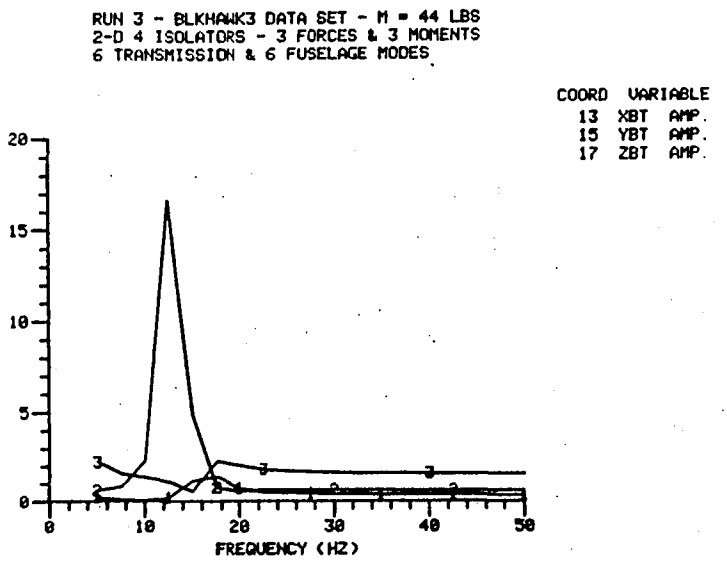
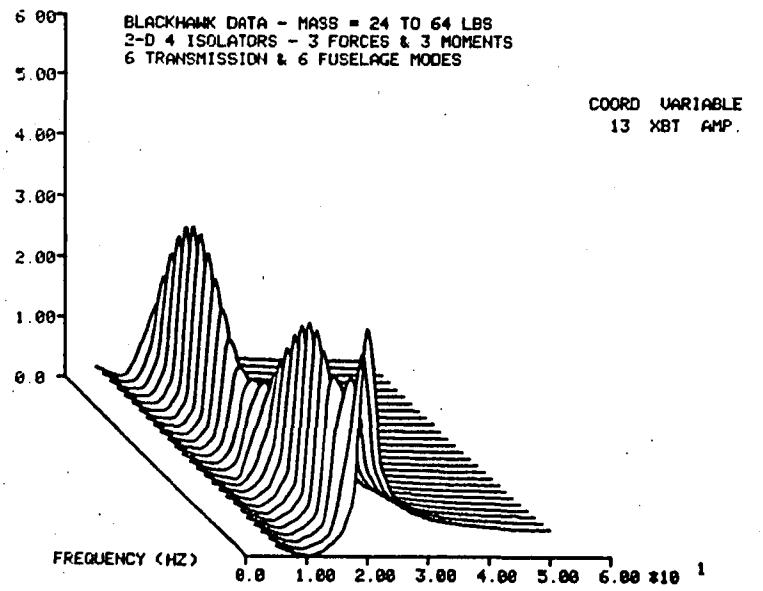


FIGURE 2B



With the plot type selected, the question 'FAIR THE DATA?' will appear. If the question is answered no, a straight line point to point hookup of the input data points will be drawn. This is the default fairing. A yes response will provide a curve fitting of the data set yielding the appearance of a curve fitted line. Typical results of base data output and faired output are shown in Figures 3A and 3B.

When the standard plot option is selected the question, 'GRIDS?' will appear. If the answer is no (transmission of the letter N), the graphic field inside the plot axis will be left blank. There will be no grid lines. If the answer is yes, the program will ask for the grid line density. A key in of 1 will produce the grid lines as shown in Figure 4A, a key in of 2 produces the grid lines shown in Figure 4B. Increasing numbers produce increased grid line density.

The final question for this path of the program is, 'DO YOU WANT TO SELECT SCALES?' If answered no, the program will select the scales to insure that all values in the data array will fit within the frame. The user can select his own scales with a key in of Y (yes). With this input, the data array minimum and maximum values will be listed on the screen for reference along with the method for input of the scale range data. These inputs are in F10. Format and the decimal point must be included. Enlargements of curve areas can be attained by selecting scales.

After all items are answered, the curves will be drawn. After the plot is complete, the hold state will be re-entered for user review, making copies, etc. The user must transmit a decimal point for program continuation.

For all plots, the ordinate axis labels are listed in an output block to the right of the curve frame. The reference numbers indexed on the curves refer to the curve number and are associated with the order of the coordinates as they appear in this list. Thus, a curve indexed with a 3 refers to the third coordinate in the output list, 4 the fourth, etc. - see Figure 3. The case numbers used to generate the plots are listed in increasing order below the ordinate axis labels, as shown in Figure 2A for one case and in Figure 2B for 5 cases.

As discussed above the procedure for obtaining surface plots is the input of 'Y' in response to the question, 'SURFACE PLOTS?' The selection of this option for different variables from a given case might not have a definitive meaning, the following discussion is intended to familiarize the user with the questions asked on this path of the program.

When this path is selected, the program will first offer the user the option to select the axis length. The axis length refers to the number of divisions to use on the abscissa and ordinate axes. The user can select from 4 to 8 divisions. A default of 6 is used if the answer is returned 'NO'. If the user says yes "Y", the program will request the axis length desired. The value is keyed in I1 format.

After selecting the axis length, the question 'COMPRESS Y-AXIS DATA?' will be asked. This refers to the ordinate axis scale for presenting the curve. The base program is designed to maximize the screen area for plotting. In most cases, plotting this ordinate data full scale overpowers the X-axis data and the effects of trending are lost. To overcome this, the user has the option to control the Y-axis data by squeezing it down. Thus an input of 2 would plot the ordinate data half size, 3 one-third size, etc. The program default is set at 1.

The next series of questions refers to the observer's position with respect to the data - refer to Figure 5A as the baseline plot. The question 'REVERSE CURVE ORDER?' allows the user to reverse the order of the data input for simulating the depth dimension. This becomes useful when the input data set is such that the data in front conceals a large portion of the rear data - see in Figure 5B. The ordinate variables will always be plotted as listed - in a front to rear order.

The question 'REVERSE ABSCISSA?' effectively permits the user to view the data trends which might be hidden on the 'RIGHT' side of the data - see Figure 5C.

The question 'INVERT ORDINATE?' allows the user to "TURN THE DATA OVER' for viewing from the bottom - see Figure 5D.

When the curve order is reversed, a message 'DEPTH REVERSED' will be written on the plot. When the abscissa is reversed or the ordinate inverted, the curve scaling will also be reversed.

It should be noted that any combination of these three items can be used.

FIGURE 3A

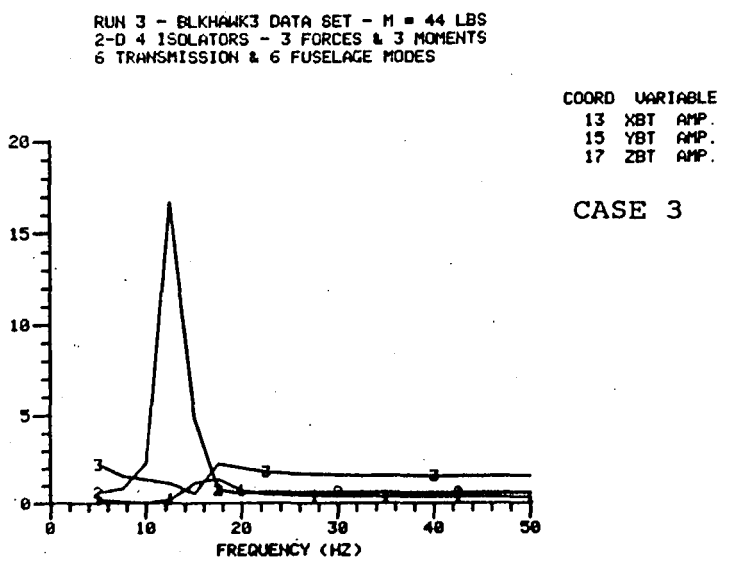


FIGURE 3B

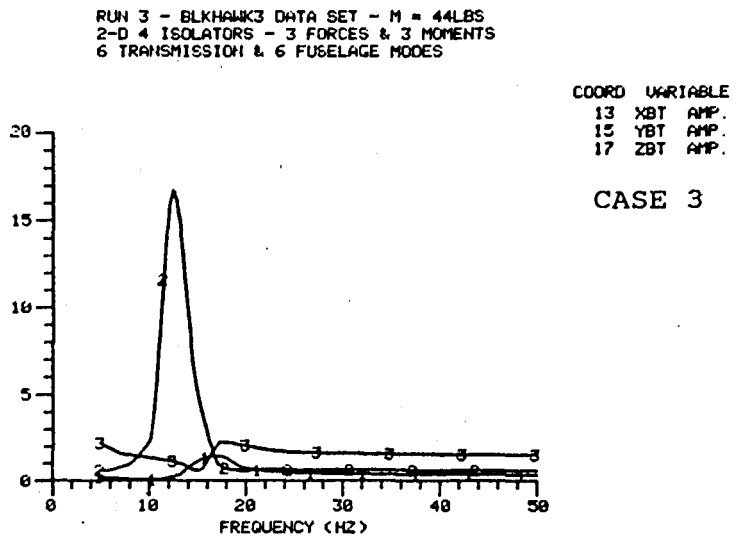


FIGURE 4A

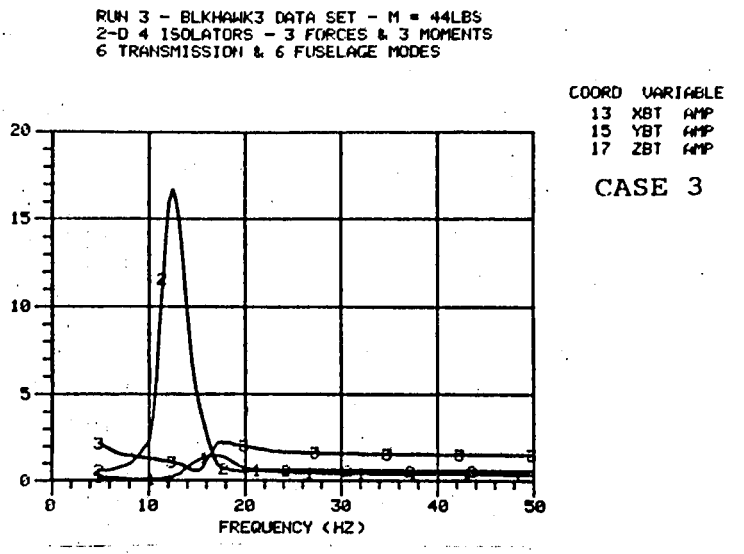


FIGURE 4B

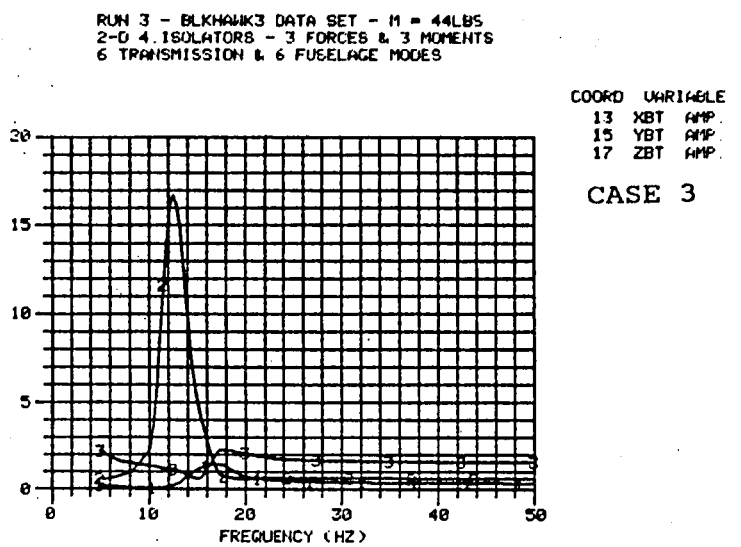


FIGURE 5A

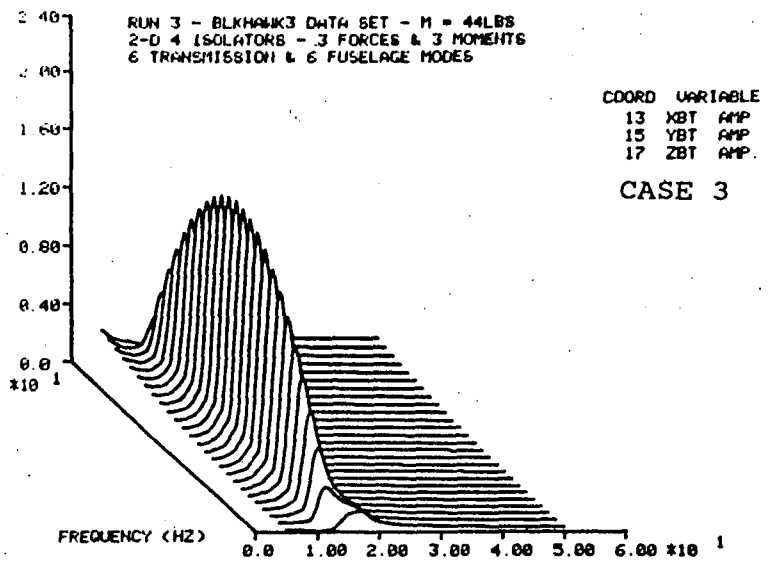


FIGURE 5B

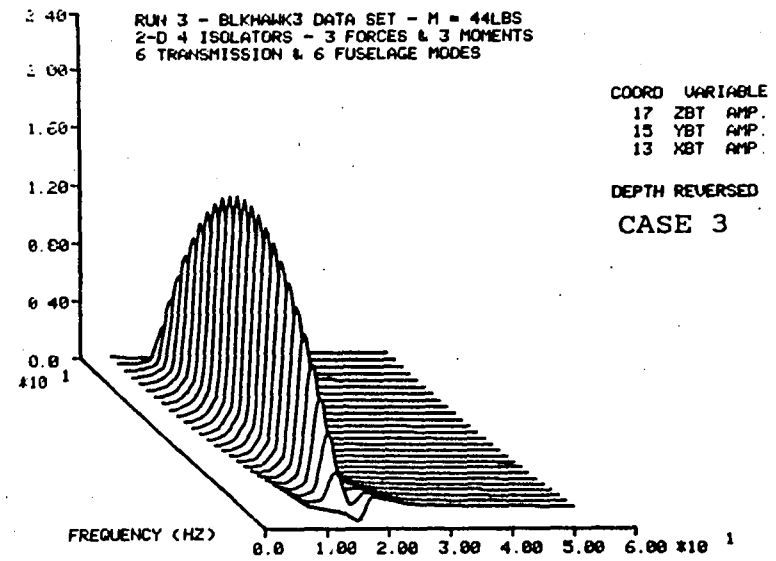


FIGURE 5C

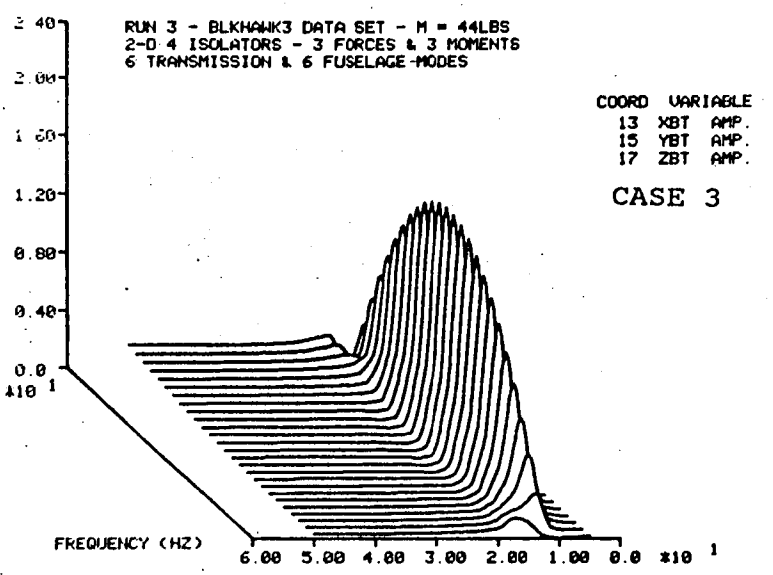
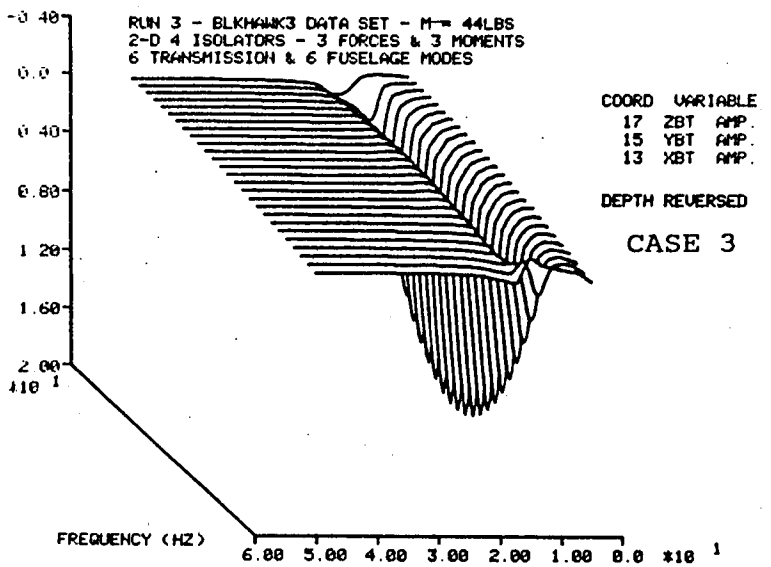


FIGURE 5D



The next question 'CHANGE CURVE DENSITY?' refers to the number of interpolated curves to generate for the surface plot. The program will interpolate between the input curves to provide an apparent surface showing the trending of a third axis parameter. This input establishes the number of divisions to use for this interpolation. A minimum input corresponding to the number of curves - see Figure 6A, or a maximum input of 26 - see Figure 6B, or any desired value within this range can be selected. I2 format is used and a minimum of 3 curves must be selected for the generation of surface plots. If surface plots have been selected with less than 3 curves, the program will produce a standard X-Y plot of the data by default.

Periodically, in the generation of surface plots, the user may encounter a message, 'MAXIMUM DIMENSION EXCEEDED' part way through the drawing of a surface plot. This message is triggered to protect the program from exceeding the allocated storage limits. Some data sets are not amenable to surface generation by the algorithms used. These data sets are generally those in which all lines are visible on the surface generated. If this message appears, transmission of a decimal point will allow the program to continue.

When the curve is complete the program will go into a hold state for user review, copy, etc. After transmission of a decimal point the question 'CHANGE ORIENTATION?' will appear. If the user replies yes 'Y', all questions from the 'SELECT AXIS LENGTH?' to 'CHANGE CURVE DENSITY? will be repeated. A 'NO' response will return the program to the question 'REPLOT THIS DATA SET?' A yes response at this point will bring the user to the plot type selection for any replotting of the current data set. For a 'NO' response, the question 'TERMINATE PLOT SESSION???' will appear. A yes response to this question will terminate the program, a 'NO' response will allow the user to get back to the top of the program for selection of different variables and/or different cases. This program cycle is repeated until the user terminates the plot session.

MULTIPLE CASE PLOTTING

The graphics package has provisions for plotting any given variable from different cases. In order to access this capability, the user must first run the analysis cases so that the output data go to a sequential data set. Once this file has been generated, the graphics package can be used to select any given coordinate from a maximum of any 5 cases. This portion of the graphics package is activated when the user responds 'NO' to the question 'ARE ALL THE CURVES FROM THE SAME CASE?' When taking this branch the program will respond, 'KEY IN THE n CASE NUMBERS, nI2 FORMAT' where n refers to the number of cases requested. The input case numbers can be selected in random order and the program

FIGURE 6A

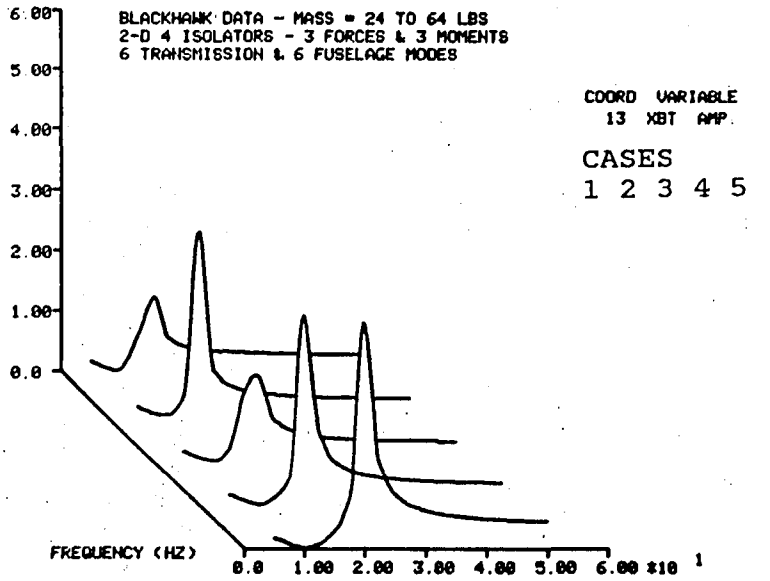


FIGURE 6B

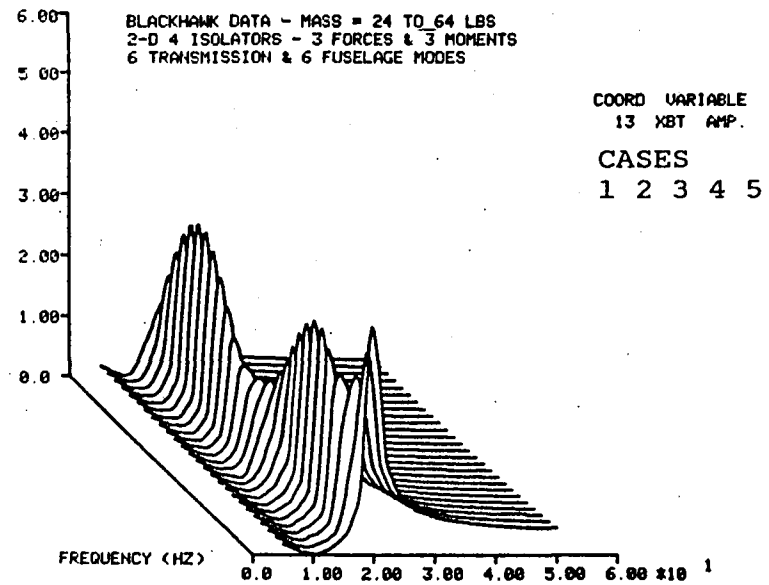


FIGURE 6C

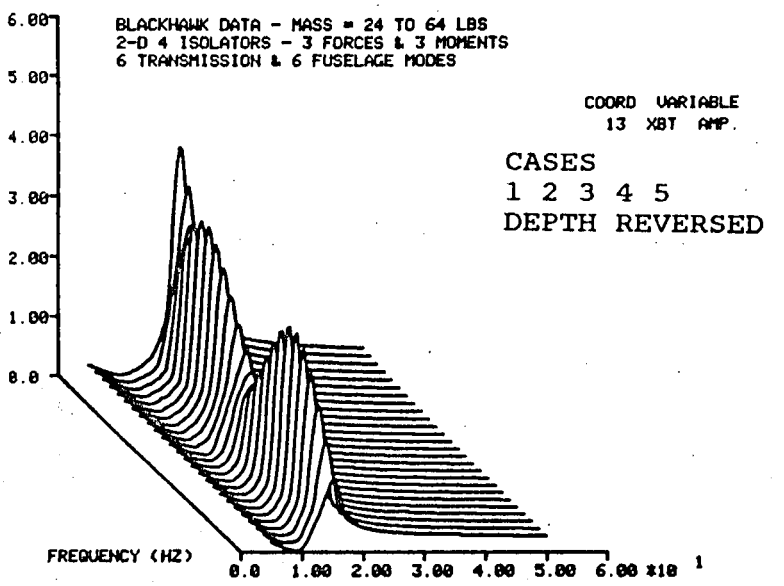
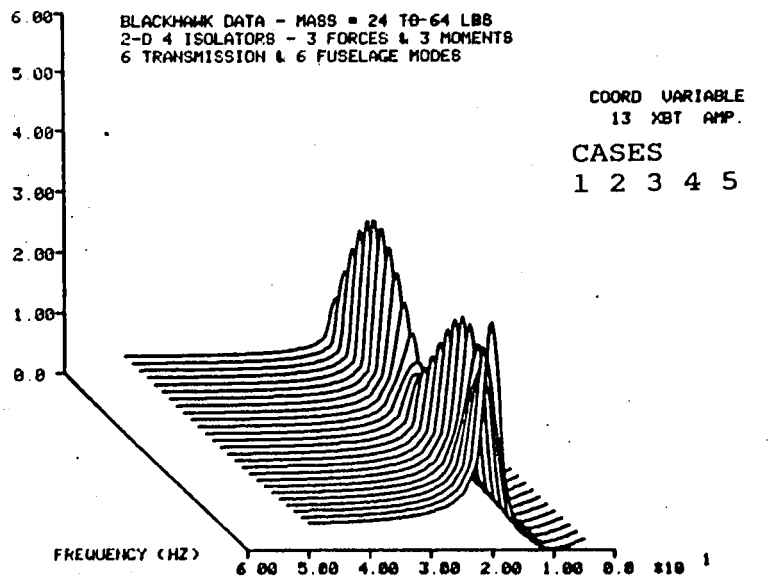


FIGURE 6D



will always plot them in the requested input order. An exception to this is when a third variable (depth parameter) is specified on the engineering program output file. When this third variable is specified, the data will always be plotted with this third variable in monotonically increasing order, independent of the order of case selection - see Figures 6A through 6D.

The program will then ask for the variable (coordinate number) to be used for plotting.

All curve selection options and input requirements from this point on are the same as discussed in the single case plotting section. The one difference in output is the interpretation of the curve index numbers used on the standard plots. In this case the index numbers are referenced to the case numbers by the order in which the case numbers were input. That is, if the input order of the case numbers was 5 2 7 9 11, then curve index number 1 refers to case 5, 2 to case 2, 3 to case 7, etc.

PROGRAM DEFAULTS

The graphics package developed for the Coupled Rotor/Airframe Vibration Analysis has been designed to provide the maximum flexibility for user input while at the same time protect the user from errors or inadvertent -'RETURN' key inputs. To aid the user in interpreting the plotted results of a curve output which does not agree with the intended input, a listing of the paths the program will take with various input errors is provided.

First, the program will plot the curves requested, provided the requested variable(s) and/or the requested case(s) are on the assigned file. If all these variable(s) or case(s) are not on the file, the program will plot the variables it finds. If none of the variable(s) or case(s) can be found, the program will write a message to the screen of either 'REQUESTED VARIABLE(S) NOT IN THIS CASE' or 'REQUESTED CASE(S) NOT ON THIS FILE'. The program will switch back and ask, 'REVIEW CASE TITLES?'. A check is advised, you might have the wrong file.

When the question, 'HOW MANY CURVES ON THIS PLOT? - 5 MAX-' is asked, the user must input a value between 1 and 5. Any input value outside this range will cause the message 'FIVE (5) CURVES MAXIMUM ++ RE-SELECT++' to be printed. The user must re-input the number of curves desired to continue.

The program was designed with the capability of handling a maximum of 150 points for a given curve. If the number of points for a given parameter exceeds this, only the first 150 points will be plotted.

If the user inadvertently hits the return key when the statement 'KEY IN THE n CASE NUMBERS DESIRES' appears, the program will assume the first n cases on the file. If 5 cases were requested and only 4 values input, the fith case will be assumed to be the case following the requested fourth case. If only 3 case numbers were input, case 4 and 5 will be assumed to be the next 2 after the requested third case, etc.

As an example: The user requested 5 cases and input the case number 1 7 9 0 0. The program will retrieve case numbers 1 7 9 10 11 if cases 10 and 11 exist. If cases 10 and 11 do not exist, then only cases 1 7 and 9 will be plotted.

Surface plots can only be constructed when 3 or more curves are requested. If the user asks for surface plots and only 1 or 2 curves have been requested, the program will default to the standard plot for output.

In some cases, all hidden lines are not removed in the surface plots. This generally occurs when the data exhibits extremely steep slopes, in the ordinate array. The removal of hidden lines requires a precise calculation of line intercepts and their removal is a direct function of the precision of the computer system used. The program as developed is designed for IBM 370/168 computer precision.

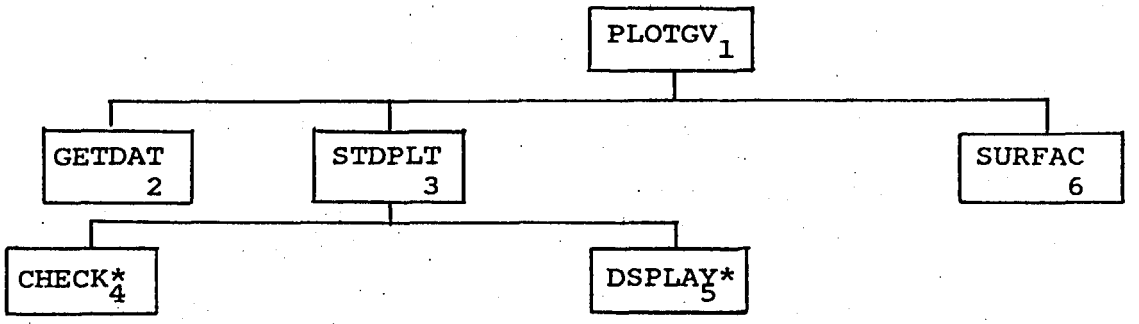
As previously mentioned, there is no recovery from a bad baud rate input, except to start over.

PROGRAM STRUCTURE

The Graphics Package for the Coupled Rotor/Airframe Vibration Analysis Package was designed to permit an overlay capability. This capability was provided to minimize core requirements for interactive operation. The structure of the overlay control routines are shown in Sketch 1. A listing of all subroutines developed and provided for this contract are included in Table 1. This listing provides a cross reference between the common blocks used and subroutines called.

The entire plot package consists of 160 subroutines and inclusion of the details of each of these subroutines is not consistent with the purpose of this document. Sufficient information is provided to execute all of the capabilities of the graphics package.

PLOTGV OVERLAY STRUCTURE



SKETCH 1

*Tektronix TCS 10 and AG II
supplied by the Government

PROGRAM INSTALLATION

The Coupled Airframe-Rotor Vibration Evaluation Graphics Package was developed on an IBM 370/168 computer system. The base Fortran code used in this development was designed for computer independence as much as practical. Four areas in which computer independence is not available is in computer precision, end of file tests and encode operations. To accommodate this, four (4) subroutines require a special version for each operating system. These subroutines have been set up for CDC operating system requirements. The affected subroutines are:

REVUE GETIT	END OF FILE AND PRECISION TESTS
XAXIS YAXIS	ENCODE OPERATIONS

An overlay structure was used for program checkout on the IBM operating system. For CDC operation, a segmentation structure is used. The control cards for system implementation of this segmentation structure are listed in Figure 7.

The graphic package requires the Tektronix Plot 10 Level 3.2 and the AG II Level 1.3 software package for proper operation.

PROGRAM OPERATION

The Job Control Language, JCL, used for running the graphic program as installed on the LRC CDC Computer System is shown in Figure 8.

```
* /JOB
* /NOSEQ
  SVPLOT,T1400,CM300000.
  USER,--------.
  CHARGE,-------,LRC.
  RFL(300000)
  GET,FILE10.
  FTN(I=FILE10,R=0,L=TAPE1,B=PLTSGO,A)
  REPLACE(PLTSGO)
  ATTACH(LIBFTEK/UN=LIBRARY)
  SEGLOAD(B=SVPABS)
  LDSET(LIB=LIBFTEK,PRESET=ZERO,MAP=SBEX/LMAP)
  LOAD(PLTSGO)
  NOGO.
  REPLACE(SVPABS)
  DAYFILE,JCLOUT.
  REPLACE,JCLOUT.
  REPLACE(TAPE1=FORT10)
  REPLACE,LMAP.
  EXIT.
  DAYFILE,JCLOUT.
  REPLACE,JCLOUT.
  REPLACE(TAPE1=FORT10)
  REPLACE,LMAP.
* /EOR
   PLOTGV GLOBAL TERM,DATA,POINTS,MIMAX,CLABEL,CASEX,BPPCOM,TKTRNX,JTB
        TREE   PLOTGV-(GETDAT,STDPLT-(CHECK,DSPLAY),SURFAC)
        END    PLOTGV
* /EOF

* For card images operation:

      1. delete /JOB and /NOSEQ instructions (first 2 cards).
      2. replace /EOR with a 6/7/8 multiple punch card.
      3. replace /EOF with a 6/7/8/9 multiple punch card.
```

FIGURE 7. CDC JCL FOR INSTALLATION OF THE GRAPHICS PROGRAM.

```
. . . FOLLOW NORMAL LOGON PROCEDURE  . . . . .

  GET,SVPABS.
  GET,TAPE2=DATA1.    <===  DATA1 CONTAINS THE DATA TO BE PLOTTED
  SVPABS.

. . . AFTER "?" APPEARS, KEY IN "." (PERIOD) AND CLEAR THE SCREEN.
. . . THE PROGRAM ASKS THE USER VARIOUS QUESTIONS.
. . . THE USER MUST BE CAREFUL TO ANSWER EACH QUESTION WITH
. . . "Y" FOR YES AND "N" FOR NO. A "." DEFAULTS TO NO.
. . . IF NO INPUT IS ENTERED, THE PROGRAM EXECUTION IS TERMINATED.

. . . UP TO 5 VARIABLES FROM ONE CASE CAN BE PLOTTED ON ONE GRAPH.
. . . ONE VARIABLE FROM UP TO 5 CASES CAN BE PLOTTED ON ONE GRAPH.
. . . STANDARD (2-D) AND SURFACE (3-D) PLOTS CAN BE GENERATED.
. . . THE USER SHOULD CONSULT THE MANUAL BEFORE EXECUTING THE
. . . SIMVIB PLOT PROGRAM.
```

FIGURE 8. CDC JCL FOR EXECUTION OF THE GRAPHICS PROGRAM.

TABLE 1

GRAPHICS PACKAGE ROUTINES

ROUTING NAME	PURPOSE	ARGUMENT LIST	COMMON BLOCKS	EXTERNAL REFERENCES
PLOTGV	MAIN PROGRAM	REQ'D FILES	TERM,DATA,POINTS,MIMAX,CLABEL	GETDAT,TYPE,PLOT10,AGII,PTS1
GETDAT	SOLICITS PLOT INFORMATION	KU	TERM,DATA,POINTS,MIMAX	GETIT,CLDSRT,REVUE,PTS1
GETIT	RETRIEVES DATA FROM FILE KU	KU,N,L,IERR	DATA,POINTS,MIMAX,CLABEL	-
REVUE	PROVIDES USER A REVIEW OF FILE DATA	KU	TERM	PTS1
TYPE	SOLICITS FOR PLOT TYPE	IRET	TERM,POINTS	STDPLT,SURFAC,PTS1
FAIRIT	SETS UP DATA FOR CURVE FITTING	X,Y,XB,YB--	MIMAX	INTRPL
TSYM	SETS UP CURVE TITLES	K	POINTS CLABEL	PLOT10, AGII
PST1	PROVIDES SCREEN ERASURES	IRD	-	PLOT10,AGII
CLDSRT	SORTS DATA ARRAYS	X,Y	-	-
INTRPL	CURVE FITS DATA SET	IU,X,Y---	-	-
STDPLT	SETS UP STANDARD X-Y PLOTS	IF	TERM,LSCODE,WINDL,IGRID INDX,DATA,POINTS,MIMAX,CLABEL	ZSET,NULL,TUBPLT,FAIRIT,TSYM, PTS1
ZSET	INITIALIZES PLOT Z VECTOR	Z,1PTS	-	-
NULL	INITIALIZES PLOT COMMONS	-	LSCODE,IGRID,WINDL,INDX,	-
TUBPLT	CONTROLS X-Y CURVE PLOTTING	X,Y,Z	TERM,LSCODE,WINDL,IGRID	CLOC,EQRES,EQRES1,LIMITS,BIVAR,
LIMITS	SETS UP DEFAULT SCALING	X,Y,Z	PLTYPE	TCS10
BIVAR	SETS UP BI-VARIATE PLOTS	X,Y,Z	PLTYPE,LSCODE,INDX	LIMITS,UNIPLT,TCS10,AGII
UNIPLT	SETS UP X-Y DATA FOR PLOTTING	X,Y,Z	INDX,LSCODE,IGRID	EPLT,MORLIN,TITL,ALABEL,TCS10,AGII
MORLIN	CONTROLS GRID DENSITY	-	IGRID	TCS10,AGII

TABLE 1 (Cont'd)

GRAPHICS PACKAGE ROUTINE

ROUTING NAME	PURPOSE	ARGUMENT LIST	COMMON BLOCKS	EXTERNAL REFERENCES
ALABEL	CONVERTS AXIS LABELS TO ASCII	ALPHA,ICHAR, IDIR,LOCX,LOCY	-	TCS10,AGII
SURFAC	CONTROLS SURFACE PLOTS	IF	TERM,DATA,POINTS,MIMAX, CLABEL,CXCY,TERN	SETIT,CLDSRT,PHIL,FAIRIT,HIDE, PTS1,TCS10,AGII
PHIL	CROSS INTERPOLATES DATA ARRAY	X,ZIN,IR,IG	DATA,POINTS	INTRPL
SETIT	SETS UP CURVE SCALES FOR SURFACE PLOT	AMA,AMI	-	-
HIDE	COMPUTES LOCATION OF HIDDEN LINES	X,Y,XG,G,--	TERN	XAXIS,YAXIS,F,LOOKUP,PDATAX
F	LOCATES INTERSECTION OF 2 LINES IN SPACE	X,X1,Y,X2,Y1	-	-
LOOKUP	PERFORMS TABLE LOOKUP	X,XTBL,J	-	-
PDATAX	PLOTS VISIBLE PORTION OF CURVES	X,Y,N---	CXCY	PLOT10,AGII
YAXIS	DRAWS Y AXIS AND SCALES	YL,DELY,YMIN	CLABEL,TERN	ENCODE,(CDC),ACON(IBM)
XAXIS	DRAWS X AXIS AND SCALES	XL,DELX,XMIN	CLABEL,TERN	ENCODE(CDC),ACON(IBM)
TWIST	REVERSES ABCISSCA & ORDINATE DATA	X,Y,N---	TERN	
ROBIN	REORDERS BASE INPUT	I,Z,J,X,N	-	-

NOTE: TCS10 AND AGII ARE TEKTRONIX ROUTINES
THESE ROUTINES MUST BE SUPPLIED BY THE GOVERNMENT

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16. Abstract

This manual contains user instructions for the Tektronix Graphics Package of the Coupled Rotor/Airframe Vibration Analysis. The manual describes responses to plot package messages which the user must make to activate plot package operations and options. The manual also contains installation instructions required to set up the program on the CDC system. The manual describes the plot package overlay structure and subroutines which have to be modified for the CDC system. Operating instructions for CDC applications are included.

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